8.0 LARGE SEWAGE TREATMENT PONDS

8.1 Declaration

The following section provides the declaration portion of the ROD/RAP for the Large Sewage Treatment Ponds.

8.1.1 Location

The Large Sewage Treatment Ponds are located in the south-central portion of the Main Depot, as shown in Figure 1.1. The site contains four unlined ponds that were used for the treatment of sewage from 1941 to 1971 (Figure 8.1).

8.1.2 Assessment of the Site

A contamination assessment of the Large Sewage Treatment Ponds was conducted during the Installation Restoration Program (IRP) Group III Remedial Investigation. The results of that assessment, presented in the Group III B Sites Final RI Report (HLA, 1994b), are summarized as follows:

- Aluminum, chromium, copper, iron, lead, magnesium, mercury, silver, thallium, vanadium, and zinc were detected sporadically in surface soil at concentrations greater than background concentrations. These metals may be associated with site activities.
- Pesticides and PCB-1260 were detected in surface-soil and subsurface-soil samples in low concentrations.
- Chromium, iron, vanadium, lead, mercury, and silver detected above the estimated background concentrations in subsurface soil.
- Nitrate plus nitrite was detected at concentrations in excess of 10 milligrams per kilogram (mg/kg) in subsurface soil collected from two soil boring locations.
- Groundwater samples collected from wells and piezometers downgradient of the site did not indicate that groundwater quality has been impacted.

A potentially unacceptable risk to human health from the detected concentrations of PCBs in surface soil was identified. The high end of the risk range (6×10^{-4}) is a risk estimate based on reasonable maximum exposure (RME) for hypothetical future receptors (residents). The lower range (2×10^{-4}), the "average" exposure scenario, is based upon the current receptor scenario. Although it is unlikely that the site will ever be zoned for residential use, the recommended action for the Large Sewage Treatment Ponds is excavation and offsite disposal of the PCB-contaminated soil.

8.1.3 Description of the Selected Remedy

The selected remedy involves the excavation of approximately 3,376 cubic yards of PCB-contaminated soil. Soil will be removed from the northern unlined pond and a soil pile adjacent to the southwest end of the two large ponds will be removed (Figure 8.2). The excavated soil will be transported to a licensed offsite landfill facility for disposal. Estimated capital costs are $1,081,000.

8.1.4 Statutory Determination

The selected remedy for the Large Sewage Treatment Ponds satisfies the statutory requirements of CERCLA § 121 and § 120(a)(4). The following mandates are satisfied:

- The selected remedy is protective of human health and the environment.
- The selected remedy complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action.
- The selected remedy is cost effective.
- The selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- The selected remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

8.2 Decision Summary

This section provides the site-specific factors and analyses that were considered in the selection of the response action for the Large Sewage Treatment Ponds.

8.2.1 Site Description

The site contains four unlined ponds that occupy an area approximately 600 feet by 600 feet square. Two polyethylene-lined ponds adjacent to the site occupy an area approximately 500 feet by 1,000 feet (Figure 8.1), which are not considered part of the Large Sewage Treatment Ponds site. A soil mound (Figure 8.2) near the lagoons and sump area was added to the site as a result of initial investigations.

8.2.2 Site History and Enforcement Activities

The unlined ponds were used for sewage treatment from 1941 to 1971. The polyethylene-lined ponds, constructed to replace the unlined ponds, have been in use from 1971 to the present (Benioff et al., 1988). However, the unlined ponds reportedly have received overflow from the lined ponds

during wet times of the year (ESE, 1983). Based on field observations by HLA, release to only one of the unlined ponds has occurred as late as July 1994 (see Figure 8.2) whereas the other three of four unlined ponds are no longer used. The single unlined treatment pond that has recently been used was not part of the remedial investigation because of its "active" status.

The sewage treatment ponds receive primarily sanitary sewage, although small quantities of industrial wastes from wash sinks and shop floor drains are received occasionally (Benioff et al., 1988). Sewage treatment in the unlined ponds consisted of stabilization, evaporation, and percolation into the underlying soil. In the polyethylene-lined ponds, the treatment consists of stabilization and evaporation. When the polyethylene-lined ponds reached their capacity, excessive sanitary sewage was apparently discharged to the old unlined ponds via gravity flow through a piping system operated by a manual valve. The overflow sewage directed to the unlined ponds is subject to evaporation and percolation.

Investigations that have been conducted at the Large Sewage Treatment Ponds include the following:

- Group III Remedial Investigation, HLA, 1994
- Remedial Investigation Follow-on Well Installation and Groundwater Sampling, HLA, 1994 (Appendix V)
- Feasibility Study, HLA, 1995

The purpose of the Group III RI conducted by HLA was to ensure that potential environmental impacts associated with past and present waste management activities at the site were thoroughly investigated and, if necessary, remediated. The investigation was conducted in three stages and included surface-soil sampling, drilling and sampling of soil borings, and monitoring well installation and groundwater sampling. Stage 1 and Stage 2 sampling indicated a potential for surface soil to be contaminated with low concentrations of PCBs.

Stage 3 of monitoring well installation and groundwater sampling was conducted at the request of Cal-EPA. Stage 3 sampling confirmed that Army activities at the site had not adversely impacted

groundwater quality. Results of the Stage 3 RI are presented in Appendix V of the Final Remedial Investigation for Sierra Army Depot - Group III B Sites (1994).

A FS report that includes the Large Sewage Treatment Ponds was prepared by HLA (1995). Surface soil and shallow soil were the medium of concern identified and addressed in the FS for this site.

No enforcement activity has been associated with the Large Sewage Treatment Ponds. The site is subject to the requirements and schedule outlined in the Federal Facilities Agreement (FFA) (State of California and U.S. Army, 1991).

8.2.3 Highlights of Community Participation

One 30-day public comment period was held from February 7, 1996, to March 7, 1996. A public meeting was held at SIAD on February 22, 1996. Representatives of the Army, DTSC, and the Lahontan RWQCB were present at the meeting. Responses to site-specific questions raised by the public at this meeting are presented in Section 8.3 of this ROD/RAP.

The public participation requirements of CERCLA § 113(k)(2)(B)(i-v) and § 117, and § 25356.1 of the California Health and Safety Code were met in the remedy selection for this site. The response action presented for this site in this ROD/RAP was selected in accordance with CERCLA, NCP, Chapter 6.8 of the California Health and Safety Code, and the California Water Code. The basis for this decision is documented in the Administrative Record.

8.2.4 Scope and Role of Response Action

This ROD addresses the PCB-contaminated soil in the northern unlined pond and at a soil pile adjacent to the southwest end of the two large ponds. This area of the site poses a potential threat to human health and the environment because of the risks from possible ingestion of the soil. The purpose of this response is to prevent current or future exposure to the PCB-contaminated soil. This will be the final response action for three of the four unlined Large Sewage Treatment Ponds.

8.2.5 Site Characteristics

Contamination at the Large Sewage Treatment Ponds was suspected because small quantities of industrial waste from wash sinks and shop floor drains are occasionally received and a groundwater mound was identified beneath the site. Potential contamination at the Large Sewage Treatment Ponds was evaluated on the basis of surface-soil, subsurface-soil, and groundwater analytical data. An assessment of potential contamination at the site based on these data is provided in the following subsections.

8.2.5.1 1994 Group III RI

Surface Soil

Potential surface-soil contamination at the Large Sewage Treatment Ponds was assessed on the basis of seven composite and five discrete surface-soil samples (Figure 8.2). The surface-soil samples were collected from a depth interval between the ground surface and 0.5-foot bgs. Each composite surface-soil sample represents a composite of 10 sampling locations. The five discrete surface-soil samples were obtained from soil boring locations. Surface-soil samples were analyzed for target compound list (TCL) semivolatiles, target analytes list (TAL) metals, nitrate plus nitrite-N, and pesticides/PCBs.

Table 8.1 summarizes the analytical results for TAL metals detected in the surface-soil samples at concentrations greater than background concentrations for soil Type 365 (Ardep sandy loam). The maximum exceedance concentration detected for chromium, copper, iron, lead, mercury, silver, thallium, vanadium, and zinc has the potential to be associated with site activities. The other analytes listed in Table 8.1 were detected sporadically at concentrations greater than the soil type-specific background concentrations but fall below either the facilitywide or western U.S. background concentrations presented. Figure 8.3 presents the locations and concentrations of inorganic analytes that are potentially associated with site activities detected above the soil type-specific and regional background concentrations.

In general, Samples STP-4-SB, STP-5-SB, and STP-7-SS contained the maximum or near maximum concentrations of chromium, copper, lead, mercury, silver and/or vanadium. These samples were collected in the area between the pump house and the sewage treatment ponds. The maximum or

near maximum concentrations of mercury and zinc were detected in STP-1-SS, STP-2-SS, and STP-3-SB. These sample locations were all within the northernmost unlined sewage treatment pond. Lead was also detected in Sample STP-3-SB at a concentration that was significantly above the background concentration. Surface-soil Samples STP-5-SS and STP-6-SS contained the highest concentrations of thallium at 67.7 and 76.5 mg/kg, respectively. The highest concentration of iron (30,200 mg/kg) was detected in STP-1-SB. Samples STP-1-SB, STP-5-SS, and STP-6-SS are located within the southernmost unlined sewage treatment pond.

Nitrate plus nitrite-N was detected in the surface-soil samples collected at the Large Sewage Treatment Ponds. Surface-soil Samples STP-4-SB and STP-5-SB contained nitrate plus nitrite-N at concentrations of 180 and 45 mg/kg, respectively. As indicated in the SIAD Group III A Sites RI report (HLA, 1994), a concentration of nitrate plus nitrite-N exceeding 10 mg/kg could be related to a source of these compounds in the vicinity of the samples.

Figure 8.4 presents the locations and concentrations of the organic compounds detected in the surface-soil samples. The only TCL semivolatile organic compound detected above the certified reporting limit (CRL) in surface soil at the site was 1,4-dichlorobenzene. This compound was detected in one surface-soil sample, STP-7-SS, at a concentration of 0.58 mg/kg. This concentration is greater than the CRL value of 0.034 mg/kg for 1,4-dichlorobenzene.

Nine pesticides (2,2-bis[p-chlorophenyl]-1,1,1-trichloroethane[DDT]; 2,2-bis[p-chlorophenyl]-1,1-dichloroethene [DDE]; 2,2-bis[p-chlorophenyl]-1,1-dichloroethane[DDD]; dieldrin; endrin; heptachlor epoxide; beta-benzenehexachloride;alpha-chlordane; and gamma-chlordane) were detected in the surface-soil samples. Eight pesticides were detected in surface-soil Samples STP-4-SB and/or STP-5-SB. Sample STP-4-SB contained DDT, DDE, DDD, dieldrin, alpha-chlordane, and gamma-chlordane at reported detections of 0.068, 0.21, 3.1, 0.11, 0.1, and 0.12 mg/kg, respectively. DDT, DDE, DDD, endrin, beta-benzenehexachloride,alpha-chlordane, and gamma-chlordane were detected in soil sample STP-5-SB at 0.0232, 0.17, 0.33, 0.0147, 0.00844, 0.0406, and 0.084 mg/kg, respectively. Alpha-chlordane and gamma-chlordane were detected as a TIC of the pesticides analysis. Because alpha-chlordane and gamma-chlordane are TICs, there are no corresponding CRLs for these analytes.

Five pesticides were detected in the surface-soil samples collected at the Large Sewage Treatment Ponds using Method UB-LH17. Four of the pesticide compounds (DDT, DDE, DDD, and dieldrin) were detected in STP-2-SS, STP-3-SB, and STP-7-SS. The highest concentrations of DDT, DDE, DDD, and dieldrin detected in these samples were 0.0152, 0.013, 0.0915, and 0.0119 mg/kg, respectively. DDD was also detected in STP-1-SS, STP-2-SB, STP-3-SS, STP-4-SS (and its duplicate STP-4-SS-D) and STP-5-SS at concentrations ranging from 0.00556 to 0.0162 mg/kg. These detected concentrations were only slightly greater than DDD's CRL of 0.0027 mg/kg. Dieldrin was detected in Sample STP-1-SS at a concentration of 0.00413 mg/kg, slightly greater than the CRL for dieldrin of 0.0016 mg/kg. Heptachlor epoxide was detected only in surface-soil Sample STP-2-SB at a concentration of 0.00444 mg/kg, which was slightly greater than the CRL of 0.0013 mg/kg for heptachlor epoxide.

PCB-1260 was detected in surface-soil samples from STP-3-SB, STP-4-SB, STP-5-SB, and STP-7-SS (Table 8.3). The samples from STP-3-SB and STP-7-SS had PCB-1260 concentrations detected at 0.0576 and 0.0585 mg/kg, respectively. These concentrations are only slightly above the CRL of 0.0479 mg/kg. PCB-1260 was also detected in STP-4-SB and STP-5-SB at 1.4 and 0.248 mg/kg, respectively.

Subsurface Soil

Potential subsurface-soil contamination at the Large Sewage Treatment Ponds was assessed on the basis of 27 subsurface-soil samples collected from 5 soil borings (Figure 8.2). The samples were analyzed for TAL metals, TCL organics, pesticides/PCBs, and nitrate plus nitrite-N.

Table 8.2 summarizes the analytical results for metals detected in subsurface-soil samples at concentrations exceeding maximum soil type-specific background concentrations for subsurface soil. As indicated in Table 8.2, the concentration of five analytes in the subsurface soil exceeded background levels; however, most of these values were less than the facilitywide and regional background concentration. Figure 8.3 presents the locations and concentrations of inorganic analytes that are potentially associated with site activities detected above the soil type-specific and regional background concentrations.

Cobalt, iron, lead, mercury, silver, and zinc were detected at greater than soil type-specific and facilitywide background concentrations and are considered to be above natural conditions at this site. Cobalt, however, was detected at only slightly above the soil type-specific background concentration (15.5 mg/kg versus 15.0 mg/kg).

Subsurface-soil samples from STP-1-SB, STP-2-SB, STP-4-SB, and STP-5-SB contained nitrate plus nitrite-N concentrations greater than 10 mg/kg. Background SIAD subsurface-soil concentrations for nitrate plus nitrite-N are not available for comparison with the investigative samples. However, natural nitrate plus nitrite-N values in soil appeared to be typically less than 10 mg/kg. At Boring STP-1-SB, only one sample (a duplicate sample from a depth of 6 feet bgs) exceeded 10 mg/kg. This sample had a concentration of 10.2 mg/kg. Three subsurface-soil samples from STP-2-SB collected at 5.5, 10.5, and 15.5 bgs contained nitrate plus nitrite-N at concentrations (16.1, 38, and 12.9 mg/kg, respectively) that slightly exceeded 10 mg/kg. Deeper samples collected at STP-2-SB contained nitrate plus nitrite-N at concentrations less than 10 mg/kg. Three subsurface-soil samples from STP-4-SB contain nitrate plus nitrite-N at concentrations greater than 10 mg/kg. These samples were obtained at 3, 6, and 9 feet bgs and contained 180, 200, and 310 mg/kg, respectively, of nitrate plus nitrite-N. Three subsurface-soil samples from STP-5-SB at depths of 3, 4, and 6 feet bgs contained nitrate plus nitrite-N concentrations at levels greater than 10 mg/kg. The nitrate plus nitrite-N concentrations at 4 and 6 feet (16 and 58 mg/kg, respectively) were lower than the levels detected at 3 feet (220 mg/kg). These three subsurface-soil samples are considered likely to be above natural conditions at this site.

Figure 8.4 presents the locations and concentrations of the organic compounds detected in the subsurface-soil samples. Trichlorofluoromethane was the only TCL volatile organic compound detected in the subsurface-soil samples. A soil sample collected from STP-4-SB at a depth of 3 feet bgs and its duplicate sample collected at 3.5 feet bgs contained trichlorofluoromethane at concentrations of 0.0064 and 0.0057 mg/kg, respectively. These concentrations of trichlorofluoromethane are similar to or less than the CRL value of 0.0059 mg/kg. Because trichlorofluoromethane can be associated with a laboratory contaminant and because the concentrations of this compound

are very low, the detected concentrations of trichlorofluoromethane in the above soil samples are considered to be laboratory contaminants and not associated with site conditions.

Seven pesticides were detected in the Large Sewage Treatment Ponds subsurface-soil samples collected at STP-4-SB and/or STP-5-SB. These pesticides included DDE, DDD, DDT, dieldrin, beta-benzenehexachloride, alpha-chlordane, and gamma-chlordane. DDE and DDD were detected in the soil samples from STP-4-SB at a depth of 3, 6 and 9 feet and in the soil Sample STP-5-SB collected at a depth of 3 feet. DDD was also detected in the soil sample collected from STP-5-SB at a depth of 4 feet. The DDE detected concentrations ranged from 0.0101 to 0.021 mg/kg and the DDD detected concentrations ranged from 0.0166 to 1.4 mg/kg in these samples.

DDT and dieldrin were detected in two soil samples collected at STP-4-SB, one sample at 6 feet and the other at 9 feet. DDT and dieldrin were detected at a concentration of 0.0178 mg/kg and 0.00958 mg/kg, respectively, in the shallower subsurface-soil sample that was collected at a depth of 6 feet. The other subsurface-soil sample obtained at a depth of 9 feet contained DDT and dieldrin at concentrations of 0.0276 and 0.0206 mg/kg, respectively. These detected concentrations of DDT and dieldrin were slightly greater than their respective CRLs of 0.00707 and 0.00629 mg/kg. Beta-benzenehexachloride was also detected in the soil samples collected at STP-4-SB from 6 and 9 feet. This analyte was detected at a concentration of 0.00307 and 0.01 mg/kg, respectively, which is slightly greater than the CRL of 0.00257 mg/kg.

The pesticides alpha-chlordane and gamma-chlordane were detected in two subsurface-soil samples, STP-4-SB at 6 feet and at 9 feet. These analytes were detected as TICs of the pesticides analysis using method ES-LH10 at concentrations ranging from 0.00932 to 0.044 mg/kg. Because alpha-chlordane and gamma-chlordane are TICs, there are no corresponding CRLs for these analytes.

PCB-1260 was detected in one subsurface-soil sample, STP-4-SB (9-foot sample) at a concentration of 0.262 mg/kg (Table 8.3). This concentration of PCB-1260 is only slightly greater than the corresponding CRL of 0.0804 mg/kg.

Groundwater

Potential contamination of groundwater at the Large Sewage Treatment Ponds was assessed on the basis of groundwater samples collected during Stage 1 and Stage 3 field activities.

Stage 1. Monitoring Well STP-2-MW was sampled during two rounds of sampling performed on September 16 and December 8, 1992. Samples were analyzed for TCL organics, TAL metals, nitrate plus nitrite-N, and macroparameters. TCL organics were not detected in the groundwater samples at concentrations above the CRL. The concentrations of barium, chromium, copper, and zinc were detected at levels above background groundwater concentrations as presented in Table 8.4.

Of the metal analytes detected in the groundwater samples collected from STP-2-MW at concentrations exceeding the background concentrations, barium, chromium, and copper were significantly lower than the corresponding MCL or proposed MCL. Zinc does not have a corresponding MCL or proposed MCL. Zinc was found to exceed the background concentrations at this sampling location during the first sampling period (September 16, 1992); however, the detected concentration of 80.8 μg/l was significantly below the secondary MCL drinking water standard of 5,000 μg/l. The detection of zinc in groundwater samples from this well during the second sampling period (December 8, 1992) was less than the reporting limit of 18 mg/kg.

The maximum concentration of nitrate plus nitrite-N detected in groundwater collected at this site was 2,900 μg/l (Table 8.4), which is lower than the drinking water MCL for nitrate plus nitrite-N of 10,000 μg/l.

As shown on Table 8.4, four pesticides were detected during the first sampling period including DDT, dieldrin, heptachlor epoxide, and isodrin. The concentrations of these analytes detected during the first sampling period ranged from 0.00298 to 0.019 μg/l, which were slightly above the corresponding CRLs. Isodrin was detected in the rinse blank associated with these samples at a concentration of 0.00406 μg/l. The detection of isodrin in the associated rinse blank may indicate a source of this compound that is not related to the investigative sample. These analytes were not detected during the second sampling period. Two pesticides (alpha-benzenehexachloride [BHC] and alpha-

endosulfan/endosulfan I) were detected during the second sampling period. However, the analytical data for these analytes were flagged as being out of control but accepted because of high recoveries of control analytes. Control analytes are specified in USAEC and are introduced into the sample train by laboratory personnel to monitor analytical performance. The detected pesticide analytes are not likely associated with groundwater conditions at STP-2-MW because (1) the above pesticides were not consistently detected during both sampling periods, (2) isodrin was detected in an associated rinse blank, and (3) alpha-BHC and alpha-endosulfan/endosulfan I detections were flagged as being "out of control."

Stage 3. Potential contamination of groundwater at the Large Sewage Treatment Ponds area was further assessed during Stage 3 on the basis of groundwater samples collected from one monitoring well and six piezometers in November 1994 and February 1995. Figure 8.2 shows the locations of the monitoring well and piezometers where groundwater samples were collected at the Large Sewage Treatment Ponds. Samples were analyzed for nitrate plus nitrite-N, TCL organics, TAL metals, and macroparameters.

Table 8.4 provides a summary of the analytical results for inorganics detected in the Large Sewage Treatment Ponds groundwater samples at concentrations greater than Large Sewage Treatment Ponds background groundwater concentrations and facilitywide background groundwater. Table 8.3 also provides a summary of results for organic analytes detected in the Large Sewage Treatment Ponds groundwater samples. Available federal and California (state) MCLs are included in Table 8.3.

Several inorganic analytes present in the Large Sewage Treatment Ponds groundwater samples, including metals, cations, and anions, were detected at concentrations exceeding federal or state MCLs. Analyte concentrations exceeding federal or state MCLs are shown in bold type in Table 8.4. Analytes most commonly exceeding the respective MCLs were sulfate, total dissolved solids (TDS), nitrate/nitrite, and manganese. The sulfate and TDS detections are likely to be associated with naturally high salinity observed in groundwater collected from the SIAD site (HLA, 1994b). The observed sulfate concentrations in the Large Sewage Treatment Ponds groundwater samples were well below the maximum facilitywide 14,000,000 μg/l background sulfate concentration. Nitrate/

nitrite was observed in samples collected from STP-3-PZ (57,000 µg/l), STP-4-PZ (23,000 µg/l), and STP-6-PZ (11,000 µg/l) during the November 1994 sample round and STP-3-PZ (36,000 µg/l), STP-4-PZ (34,000 µg/l), and STP-6-PZ (12,000 µg/l) during the February 1995 sample round. These analyte concentrations exceed the federal 10,000 µg/l limit for nitrate and one value slightly exceeds the 45,000 µg/l state limit. The use of this site for wastewater treatment in July 1994 may have contributed to elevated nitrate levels in groundwater through the biological conversion of ammonia to nitrate.

Manganese concentrations consistently exceeded the secondary federal and state MCL standard (50 µg/l) for manganese. However, these concentrations are believed to be representative of naturally occurring levels. HLA reviewed a USGS bulletin regarding development of mineral resources in the Skedaddle Mountains (USGS, 1988e) during research for background data. This USGS bulletin reported sediment samples from Skedaddle Mountain streambeds to have naturally occurring 2,000 mg/kg concentrations of manganese. Army activities that may have resulted in a discharge of manganese into these ponds have not been identified; however, a discharge of wastewater in July 1994 was reported. This discharge of highly organic carbon-enriched water may explain the increased manganese concentrations. Manganese exists in soil principally as manganese dioxide, which is insoluble in water containing carbon dioxide. Under reducing (anaerobic) conditions, the manganese in the dioxide form is reduced from an oxidation state of IV to II and solution occurs, as with ferric oxides (Sawyer and McCarty, 1978). Wastewater percolating into soil below the sewage treatment ponds may contain organic carbon. The biological conversion of the organic carbon may deplete available oxygen, increase carbon dioxide levels and increase solubility of the manganese present in the soil contributing to the elevated concentrations of manganese observed in groundwater collected during the November 1994 and February 1995 sampling events.

Organic analytes that were detected in the groundwater samples collected during the Stage 1 sampling rounds included the pesticides DDT, alpha- and delta-BHC, alpha-endosulfan, dieldrin, heptachlor epoxide, and isodrin. The concentrations of these compounds were less than 0.02 µg/l, with one exception for the unconfirmed detection of delta-BHC. Federal and state MCLs are available for heptachlor epoxide and chloroform as shown in Table 8.4. Heptachlor epoxide concentrations

exceeded the state heptachlor epoxide MCL value for one Stage 1 sample. However, heptachlor epoxide and the other pesticides detected in the Stage 1 samples were not detected in Stage 3 samples collected during November 1994 and February 1995. Organic compounds detected in the groundwater samples collected in 1994 included chloroform in one groundwater sample (STP-2-MW). Chloroform was also detected in the associated rinse blank and was not detected during the February 1995 sampling event.

During the second round of Stage 3 sampling (February 1995) for piezometers STP-5-PZ and STP-6-PZ, TCE was reported at low concentrations (1.20 µg/l and 0.56 µg/l, respectively). (The certified reporting limit for TCE for these data is 0.50 µg/l.) The detection of TCE in groundwater is suspect because of (1) the spatial distribution of these detections, (2) the fact that sampling of these wells was conducted after sampling of wells with known concentrations of TCE, and (3) the fact that the sequence of sampling of wells at the site with the HLA Grundfos pump was STP-5-PZ, STP-6-PZ, and STP-8-PZ followed by the remaining piezometers and wells at this site.

HLA resampled the two piezometers, STP-5-PZ and STP-6-PZ, in April 1995 to verify the first or second round of Stage 3 analytical data. The analytical results of this resampling and analysis of groundwater from Piezometers STP-5-P2 and STP-6-P2 revealed no TCE in groundwater and verified the first round of Stage 3 VOC analytical data. These results support the conjecture that TCE was introduced into groundwater samples collected from Piezometers STP-5-P2 and STP-6-P2 during the February 1995 sample collection process and is not the result of groundwater contamination.

8.2.6 Summary of Site Risks

This section summarizes the baseline risk assessment conducted for the Large Sewage Treatment Ponds during the Group III B Sites RI.

8.2.6.1 Contaminant Fate and Transport

Fate and transport properties were evaluated for chemicals identified as COPCs at the Large Sewage Treatment Ponds in the Group III B Sites Final RI Report (HLA, 1994b). The purpose of evaluating fate and transport properties of COPCs was to assess the potential for these COPCs to migrate to other media or to human or ecological receptor locations (Figure 8.5).

COPCs identified in soil collected from the Large Sewage Treatment Ponds included metals, low-level pesticides, and PCBs. Chemical release and transport mechanisms considered for this site include (1) volatilization from soil to air, (2) dust entrainment, and (3) storm-water runoff.

Volatilization from soil to air is not expected for metals because metals are essentially nonvolatile. The pesticides and PCB-1260 detected in onsite soil are all chemicals with only moderate Henry's Law constants (Lyman et al., 1990) and high soil-water partition coefficients (K_{oc}) (Dragun, 1988). The combination of moderate Henry's Law constants with high K_{oc} values means that these organic chemicals are likely to bind tightly to organic matter in soil and will not volatilize.

The same properties that limit volatilization of metals, pesticides, and PCBs from soil also make them more likely to bind tightly to soil particles and potentially be released from the site as suspended dust particles in air.

Chemicals sorbed to soil particles may also be carried offsite by storm-water runoff. The runoff potential at the site is expected to be low, however, because of the greater infiltration rate associated with the high sand content of the soil at this location.

8.2.6.2 Human Health Evaluation

The results of the human health risk estimation for the Large Sewage Treatment Ponds are summarized in Table 8.5. Possible noncancer health effects and cancer risks were evaluated separately. For current onsite worker receptors, the maximum estimated HI of 2 indicated a slight chance that noncancer health effects (primarily associated with ingestion of and dermal contact with thallium in soil) may be of concern at this site. However, this estimate was based on RME exposure and, as such, probably overestimates the potential for adverse health effects in current workers. However, the maximum estimated HI of 10 for future hypothetical receptors indicates that noncancer health effects (again associated with ingestion of and dermal contact with thallium) may be of concern in the future if these unlikely exposure scenarios were to occur. However, the maximum detected concentration of thallium was 76.5 mg/kg; the EPA Region IV preliminary restoration goal for industrial soil is 120 mg/kg.

The cancer risk estimates ranged from 2×10^{-6} to 6×10^{-4} for current and hypothetical future receptors. The high end of this range was primarily associated with dermal contact and ingestion of PCB-1260 in soil by future hypothetical resident receptors. These risk estimates indicate that some potential cancer risks at the site are in the range of regulatory concern. However, the high end of this range (6×10^{-4}) is a risk estimate based on RME exposure. For more typical or "average" exposure, the risks presented in the Final Group III B Sites RI Report are in the lower range (2×10^{-6}). In addition, it is highly unlikely that the Large Sewage Treatment Pond area would ever be zoned for residential use even if the property were to be released to the public under base realignment.

8.2.6.3 Environmental Evaluation

A qualitative Environmental Evaluation (EE) was performed for SIAD. The purpose of the EE was to evaluate the potential for adverse effects to ecological receptors as a result of exposure to chemicals originating from chemical source areas. The potential for aluminum and thallium toxicity was indicated for the Townsend's ground squirrel, sage grouse, and the burrowing owl as a result of incidental ingestion at Large Sewage Treatment Ponds. Burrowing owls are known to inhabit the area adjacent to the southern border of the Large Sewage Treatment Ponds.

8.2.7 Description of Alternatives

Two alternatives were developed for the Large Sewage Treatment Ponds in the Group III B Sites Feasibility Study (HLA, 1995). The remedial alternatives identified include the following:

- Alternative 1: No Action
- Alternative 2: Excavation and Offsite Disposal, and limited followup groundwater monitoring

8.2.7.1 Alternative 1 - No Action

This alternative involves taking no action to treat, contain, or remove any of the PCB-contaminated soil from the site.

8.2.7.2 Alternative 2 - Excavation and Offsite Disposal

This alternative involves the excavation of approximately 3,400 cubic yards of PCB-contaminated soil. Soil will be removed from the northern unlined pond to a depth of 1 foot, and the soil pile adjacent to the southwest end of the two large ponds will be removed (Figure 8.2). The excavated

soil will be transported to a licensed offsite landfill facility for disposal. Estimated capital cost for Alternative 2 is $1,081,000. Additional characterization of the extent of PCB-contaminated soil during removal in the northern unlined pond and the soil pile may reduce the volume to be excavated as well as the cost. After the removal action is completed, two semiannual rounds of groundwater sampling will be conducted at the existing site monitoring wells. A followup report will be submitted to the DTSC.

8.2.8 Summary of Comparative Analysis of Alternatives

Each of the remedial alternatives described in Section 8.2.7 has been assessed in accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988b). That guidance and the NCP provide for analysis of nine criteria when evaluating remedial alternatives. The criteria are as follows:

- Threshold Criteria
  - Overall protection of human health and the environment
  - Compliance with ARARs.
- Primary Balancing Criteria
  - Long-term effectiveness
  - Reduction of toxicity, mobility, and volume
  - Short-term effectiveness
  - Implementability
  - Cost
- Modifying Criteria
  - State acceptance
  - Community acceptance

Threshold criteria are requirements that each alternative must satisfy to be eligible for selection as the preferred alternative. Primary balancing criteria are used to weigh trade-offs among alternatives. Modifying criteria may be used to alter aspects of the preferred remedial alternative when preparing the Proposed Plan.

In the Group III B sites FS (HLA, 1995), the remedial alternatives were evaluated in terms of threshold and primary balancing criteria. Final evaluation of modifying criteria (state and community acceptance) was conducted after completion of the comment period on the final FS.

A brief description of each of the nine criteria is presented below.

- Overall Protection of Human Health and the Environment
  - How alternative provides human health and environmental protection
- Compliance with Applicable or Relevant and Appropriate Requirements
  - Compliance with Chemical-specific ARARs
  - Compliance with Action-specific ARARs
  - Compliance with Location-specific ARARs
  - Compliance with other criteria, advisories, and guidance
- Long-term Effectiveness and Permanence
  - Magnitude of residual risk
  - Adequacy and reliability of controls
- Reduction of Toxicity, Mobility, and Volume Through Treatment
  - Treatment process used and materials treated
  - Amount of hazardous materials destroyed or treated
  - Degree of expected reductions in toxicity, mobility, and volume
  - Degree to which treatment is irreversible
  - Type and quantity of residuals remaining after treatment
- Short-term Effectiveness
  - Protection of community during remedial actions
  - Protection of workers during remedial actions
  - Environmental impacts
  - Time until RAOs are achieved
- Implementability
  - Ability to construct and operate the technology
  - Reliability of the technology

- Ease of undertaking additional remedial actions, if necessary
- Ability to monitor effectiveness of remedy
- Coordination with other agencies
- Availability of offsite treatment, storage, and disposal services and capacity
- Availability of necessary equipment and specialists
- Availability of prospective technologies

• Cost

- Capital costs
- Operating and maintenance costs
- Present-worth cost

8.2.8.1 Overall Protection of Human Health and the Environment

Alternative 1 (No Action) would not provide adequate protection to human health and the environment because of the risks posed by PCB-1260 in the site soil. Because Alternative 2 involves removing the soil and associated risks, it would achieve protection.

8.2.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

The removal alternative (Alternative 2) will comply with ARARs whereas ARARs are not relevant to the No Action alternative (Alternative 1).

8.2.8.3 Long-term Effectiveness

Alternative 2 would provide the highest degree of long-term effectiveness and permanence by removing the soil and associated risks from the site.

8.2.8.4 Reduction of Toxicity, Mobility, or Volume

Only Alternative 2 would reduce the mobility of contaminants. Neither alternative would reduce the toxicity or volume of the contaminated soil.

8.2.8.5 Short-term Effectiveness

Alternative 2 would provide short-term effectiveness if risks posed by remediation activities were mitigated (i.e., dust control). Alternative 1 provides no short-term effectiveness.

8.2.8.6 Implementability

The No Action alternative (Alternative 1) would be inherently easy to implement; however, Alternative 2 is also relatively easy to implement and meets RAOs.

8.2.8.7 Cost

There are no costs for the No Action alternative (Alternative 1); Alternative 2 would cost approximately $1,081,000 to implement. Cost savings for Alternative 2 may be possible by further characterization of the soil to be excavated, thus possibly reducing the volume of soil to be removed.

8.2.9 Selected Remedy

The Army has selected Alternative 2, excavation and disposal, as the preferred remedy for the PCB contaminated soil at the Large Sewage Treatment Ponds. Based on the results presented in the RI/FS documents for the site, the State of California concurs with the selected remedy.

Alternative 2 will involve the excavation of 3,376 cubic yards of surface soil from the northern unlined pond and a soil mound adjacent to the west end of the large ponds. The excavated soil will be transported to a licensed offsite landfill facility to be selected during the remedial design phase.

The estimated capital cost for excavation and offsite disposal of 3,376 cubic yards of PCB-contaminated soil is $1,081,000. There will be no operation and maintenance costs. Table 8.6 presents a breakdown of the estimated capital costs for Alternative 2.

8.2.10 Statutory Determinations

The selected remedy satisfies statutory requirements of CERCLA § 121 and § 120(a)(4) such that the following mandates are satisfied:

- The selected remedy is protective of human health and the environment.
- The selected remedy complies with federal and state ARARs.
- The selected remedy is cost effective.
- The selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- The selected remedy satisfies the preference for treatment that reduces toxicity, mobility, and/or volume as a principal element.

8.2.10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through the excavation of PCB-contaminated soil and offsite disposal at a licensed landfill facility. Excavation and disposal will eliminate the threat of exposure to direct contact with or ingestion of contaminated soil. The current risk associated with these exposure pathways is 2×10^{-5}. By excavating the two areas of contaminated soil and disposing the soil offsite, the risk is removed. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media inputs are expected from the remedy.

8.2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy of excavation and offsite disposal will comply with all applicable or relevant and appropriate chemical-, location- , and action-specific requirements. (A full discussion regarding SIAD ARARs is presented in Section 3.2.8.2 and are summarized in Tables 3.6 and 3.7.) The ARARs relevant to this site are presented below.

Chemical-specific ARARs

State or federal chemical-specific ARARs for constituents detected in soil at the Large Sewage Treatment Ponds have not been identified as a result of ARAR review.

Location-specific ARARs

State or federal location-specific ARARs for constituents detected in soil at the Large Sewage Treatment Ponds have not been identified as a result of ARAR review.

Action-specific ARARs

Chapter 10 of Title 22 CCR Division 4.5 (Chapter 10) contains regulations governing the management of hazardous waste. California's hazardous waste regulations are more stringent than the federal requirements in a number of ways.

Appendix X of Chapter 10 is a list of chemicals and materials that are presumed to be hazardous waste unless a generator can demonstrate that the material is not hazardous waste. Materials found on this list include PCBs, pesticides, and wastes containing these chemicals.

Disposal of PCB-contaminated soil from the Large Sewage Treatment Pond Area could trigger federal DOT material transportation requirements. DOT regulations are applicable to the shipment of media containing PCBs and other hazardous materials. DOT regulations are found in 40 CFR 100-180.

The excavation of PCB-contaminated soil and offsite disposal at a licensed facility may have to comply with the Chapter 10 hazardous waste requirements unless the generator can demonstrate that the PCB-contaminated soil is not hazardous. In addition, state and federal occupational health and safety regulations apply to the excavation and disposal of PCB-contaminated soil. These ARARs are found in Table 8.7.

Other criteria, Advisories, or Guidance to be Considered for This Remedial Action (TBCs)

None

8.2.10.3 Cost Effectiveness

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its costs. Estimated costs of the selected remedy are $1,081,800. Capital cost savings could be realized by including additional characterization of the soil to be excavated, thus possibly reducing the volume of soil to be removed. The selected remedy assures a much higher degree of certainty for risk reduction at the site than the No Action alternative.

8.2.10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final source control at the Large Sewage Treatment Ponds. This selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; and short-term effectiveness, implementability, cost, and the statutory preference for treatment as a principal element and considers Cal-EPA and community acceptance.

The selected remedy offers a high degree of long-term effectiveness and permanence. It will significantly reduce the inherent hazards posed by the contaminated soil through excavation and

offsite disposal such that any residual material that remains to be managed can be contained with a high degree of certainty over the long term. The selected remedy can be implemented quickly and with little difficulty and therefore is assessed to be the most appropriate solution for the contaminated soil at the Large Sewage Treatment Ponds. The impact on human health and the environment would be minimal if the public were allowed access to the site in the future.

8.2.10.5 Preference for Treatment as a Principle Element

The selected remedy addresses the principal threat posed by the site through excavation and offsite disposal at a licensed landfill facility. Therefore, the statutory preference for remedies that employ treatment as a principal element is not satisfied.

8.3 Responsiveness Summary

The public comment period for the Proposed Plan for Nine Sites at SIAD began on February 7, 1996, and extended through March 7, 1996. No written comments were received by the Army or regulatory agencies. The public meeting presenting the Proposed Plan was held on February 22, 1996. Oral comments were received for the Large Sewage Treatment Ponds at the public meeting.

8.3.1 Community Preferences

At the public hearing, Ms. Geralyn Smith questioned what "offsite disposal" was and expressed concern that it would be expensive. She wondered if the affected soil could be stored at SIAD, rather than be hauled to an offsite facility. Mr. John Harris, DTSC, noted that the soil must be stored at a permitted facility and that it would be cost- and time-prohibitive for SIAD to become a permitted facility of that type. Ms. Smith then asked if the Army had considered some of the new techniques, such as injecting foam into the soil. Ms. Anita Larson, HLA, noted that new and many other techniques had been evaluated during the feasibility study. Ms. Larson noted that the preferred alternative emerged based on cost effectiveness, implementability, and long-term effectiveness. Ms. Larson noted that the Army intends to reuse the area in the near future and that that reuse was included during the evaluation phase of the feasibility study. Mr. Harry Kleiser, USAEC, noted that the USAEC is a leader in identifying new technologies for the Army and that they are required to use new technologies whenever it makes sense. Mr. Kleiser noted that in some situations, as at this site, a new technology is too expensive to justify its use. Mr. Wickham, Montgomery Watson, noted that

new alternatives were evaluated at this site, the Building 1003 Area (Section 3.0), and the Existing Fire-fighting Training Facility, whose record of decision was signed in 1993.

8.3.2 Integration of Comments

The Army evaluated in situ, innovative technologies during conduct of the feasibility study for this site. On the basis of cost effectiveness, long-term effectiveness, and implementability, excavation and removal of the affected soil to a permitted storage facility remain the preferred alternative.

The public's concern was incorporated into the re-evaluation that was conducted following the Public Hearing, and the alternative identified in the feasibility study and the Proposed Plan remains the preferred alternative for this site.

Table 8.1: Summary of Analyte Concentrations in Surface-Soil Samples That are Greater Than Background Concentrations - Large Sewage Treatment Ponds[a]

	Maximum[b] Background Concentration	Maximum[c] Background Concentration	STP-1-SB	STP-1-SS	STP-2-SB	STP-2-SS	STP-3-SB	STP-3-SB
Depth (feet):	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.5**
Sample Date:	**Not applicable**	**Not applicable**	**08/20/92**	**08/22/92**	**08/20/92**	**08/22/92**	**08/21/92**	**08/21/92**
Soil Type:	**310/312/313**	**365**	**365**	**365**	**365**	**365**	**365**	**365**
Inorganic Analytes								
Aluminum	NA	6,710	23,900	9,520	19,900	9,410	12,400	NA
Arsenic	11.5	3.23	---	---	4.51[e]	---	---	NA
Barium	263	295	---	---	---	---	330	NA
Beryllium	1.86	1.86	---	---	---	---	---	NA
Cadmium	3.05	3.05	---	---	---	---	---	NA
Calcium	NA	34,300	---	---	---	---	60,000	NA
Chromium	12.7	12.7	13.9	---	---	---	---	NA
Copper	58.6	58.6	---	---	---	---	---	NA
Cyanide[d]	NA[d]	NA[d]	NA	<0.25	NA	<0.25	<0.25	NA
Iron	NA	8,440	30,200	12,300	25,900	12,200	13,800	NA
Lead	10.5	10.5	---	19.5	---	14.9	43	NA
Magnesium	NA	4,310	8,920	---	7,610	---	5,080	NA
Manganese	NA	455	---	---	---	---	462	NA
Mercury	0.0500	0.0500	---	0.238	0.0713	0.273	---	0.447
Nitrate, nitrite (nonspecific)[d]	NA	NA	23.8	8.76	9.56	7.89	2.17	NA
Potassium	NA	2,670	6,280	---	4,500	---	2,920	NA
Silver	2.50	2.50	---	8.27	---	5.63	8.56	NA
Sodium	NA	352	702	---	620	---	1,030	NA
Thallium	62.9	62.9	---	---	---	---	---	NA
Vanadium	33.8	41.0	60.7	---	60.7	---	---	NA
Zinc	34.6	30.2	64.4	121	46.1	113	133	NA

Table 8.1: Summary of Analyte Concentrations in Surface-Soil Samples That are Greater Than Background Concentrations - Large Sewage Treatment Ponds[a] (continued)

	STP-3-SS	STP-4-SB	STP-4-SS	STP-4-SB-D	STP-5-SB	STP-5-SS	STP-6-SS	STP-7-SS
Depth (feet):	0	0	0	0	0	0	0	0
Sample Date:	08/22/92	02/17/93	08/22/92	08/22/92	02/17/93	08/22/92	08/22/92	08/22/92
Soil Type:	365	365	365	365	312	365	365	312
Inorganic Analytes								
Aluminum	10,700	---	---	7,070	---	16,700	18,100	---
Arsenic	---	4.62	---	---	---	4.65	3.39	---
Barium	---	---	---	---	---	---	---	---
Beryllium	---	2.43	---	---	---	---	---	---
Cadmium	---	---	---	---	---	---	---	2.19
Calcium	---	---	---	---	---	---	---	---
Chromium	---	49.4	---	---	---	---	---	13.1
Copper	---	113	---	---	---	---	---	122
Cyanide[d]	<0.25	NA	<0.25	<0.25	NA	<0.25	<0.25	0.47
Iron	14,400	11,500	11,200	12,000	---	21,000	22,800	13,600[d]
Lead	---	297	11.5	---	37.7	---	---	---
Magnesium	5,040	---	---	---	---	8,170	8,630	---
Manganese	---	---	---	---	---	---	---	---
Mercury	0.16	0.661	0.16	0.14	0.867	0.0547	0.0563	0.656
Nitrate, nitrite (nonspecific)[d]	7.98	180	5.35	4.81	45	9.12	3.59	6.63
Potassium	2,910	2,800	---	---	---	5,070	5,820	---
Silver	---	21	4	2.42	4.7	---	---	22.3
Sodium	---	409	---	---	---	507	440	---
Thallium	---	---	---	---	---	67.7	76.5	---
Vanadium	---	440	---	---	---	57.2	63.3	---
Zinc	78.2	---	73.2	64.7	101	65.3	66.5	296

< Less than certified reporting limits
--- Analyte not detected at levels exceeding background
NA Not analyzed

a. Values are reported in milligrams per kilogram.
b. Maximum concentrations for background surface soil types 310, 312, and 313 taken from Table 5.3 of the Group III B Sites Final RI (HLA, 1994).
c. Maximum concentrations for background surface soil type 365 taken from Table 5.5 of the Group III B Sites Final RI (HLA, 1994).
d. Background concentrations were not available.

Table 8.2: Summary of Analyte Concentrations In Subsurface-Soil Samples That are Greater Than Background Concentrations - Large Sewage Treatment Ponds[a]

		Maximum Background Concentrations		STP-1-SB	STP-1-SB	STP-1-SB	STP-1-SB	STP-1-SB	STP-1-SB
Depth (feet):	**Not applicable**	**Not applicable**	**Not applicable**	**5.5**	**10.5**	**15.5**	**20.5**	**25.5**	**30.5**
Sample Date:	**Not applicable**	**Not applicable**	**Not applicable**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**
Soil Type:	**Sand[b]**	**Silt/clay[c]**	**Sand/silt/clay mix[d]**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**	**Sand**
Inorganic Analytes									
Aluminum	9,910	28,000	28,000	---	---	---	---	---	---
Cobalt	15.0	15.0	15.0	---	---	---	---	---	---
Iron	15,300	27,900	27,900	---	---	72,000	---	---	---
Lead	6.62	6.62	6.62	---	---	---	---	---	---
Mercury	0.0500	0.0500	0.0500	---	---	---	---	---	---
Nitrate, nitrite (nonspecific)	NA	NA	NA	9.03	6.12	2.37	2.58	1.34	5.57
Silver	2.50	2.50	2.50	---	---	---	---	---	---
Vanadium	52.7	130	130	---	---	203	---	---	---
Zinc	63.5	84.2	84.2	---	---	---	---	---	---

Table 8.2: Summary of Analyte Concentrations in Subsurface-Soil Samples That are Greater Than Background Concentrations - Large Sewage Treatment Ponds[a] (continued)

	STP-1-SB	STP-1-SB-D	STP-2-SB	STP-2-SB	STP-2-SB	STP-2-SB	STP-2-SB	STP-2-SB	STP-2-SB	STP-2-SB-D	STP-3-SB	STP-3-SB	STP-3-SB
Depth (feet):	**35.5**	**6**	**5.5**	**10.5**	**15.5**	**20.5**	**25.5**	**30.5**	**35.5**	**6**	**5.5**	**10.5**	**16**
Sample Date:	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/20/92**	**08/21/92**	**08/21/92**	**08/21/92**
Soil Type:	**Sand**	**Sand**	**Sand**	**Sand**	**Silty sand**	**Sand**	**Sand**	**Sand and clayey sand**	**Sand**	**Sand**	**Silty sand**	**Sand**	**Sand**
Inorganic Analytes													
Aluminum	---	---	---	---	---	---	---	---	10,400	---	---	10,100	---
Cobalt	---	---	---	---	---	---	---	15.5	---	---	---	---	---
Iron	---	---	---	17,900	---	---	---	---	---	---	---	18,700	17,000
Lead	---	---	---	---	---	---	---	---	---	---	---	---	---
Mercury	---	---	---	---	---	---	---	---	---	---	---	---	---
Nitrate, nitrite (nonspecific)	<1.00	10.2	16.1	38	12.9	1.44	<1.00	2.51	<1.00	10.7	9.1	4.92	6.52
Silver	---	---	---	---	---	---	---	---	---	---	---	---	---
Vanadium	---	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 8.2: Summary of Analyte Concentrations in Subsurface-Soil Samples That are Greater Than Background Concentrations - Large Sewage Treatment Ponds[a] (continued)

	STP-3-SB	STB-3-SB	STP-3-SB	STP-3-SB	STP-3-SB-D	STP-4-SB	STP-4-SB	STP-4-SB	STP-4-SB-D	STP-5-SB	STP-5-SB	STP-5-SB-D
Depth (feet):	20.5	25.5	30.5	35.5	15.5	3	6	9	3.5	3	6	4
Sample Date:	08/21/92	08/21/93	08/21/92	08/21/93	08/21/92	02/17/93	02/17/93	02/17/93	02/17/93	02/17/93	03/02/93	02/17/93
Soil Type:	Sand	Sand	Sand and clay	Sand	Sand	Silty sand	Silty sand	Silty sand	Silty sand	Silty sand	Silty sand	Silty sand
Inorganic Analytes												
Aluminum	---	---	---	---	12,800	---	---	---	---	---	---	---
Antimony	---	---	---	---	---	---	---	---	---	---	---	---
Cobalt	---	---	---	---	---	---	---	---	---	---	---	---
Iron	---	---	---	---	17,900	---	---	---	---	---	---	---
Lead	---	---	---	---	---	---	---	26.5	---	---	---	---
Mercury	---	---	---	---	---	---	---	0.32	---	---	---	467
Nitrate, nitrite (nonspecific)	1.39	<1.00	1.72	2.58	4.03	180	200	310	120	220	58	16
Silver	---	---	---	---	---	---	---	6.11	---	---	---	---
Vanadium	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	---	---	---	---	---	---	---	167	---	84.8	---	---

< Less than certified reporting limit
--- Analytes not detected at levels exceeding background

a. Values are reported in milligrams per kilogram.
b. Maximum background concentrations for subsurface sandy soil taken from Table 5.8 of the Group III B Sites Final RI (HLA, 1994).
c. Maximum background concentrations for subsurface silt and clay soil taken from Table 5.9 of the Group III B Sites Final RI (HLA, 1994).
d. Maximum background concentrations for subsurface soil consisting of sand, silt, and clay taken from Table 5.7 of the Group III B Sites Final RI (HLA, 1994).

Table 8.3: Summary of Polychlorinated Biphenyl 1260 Detections in Surface and Subsurface Soils - Large Sewage Treatment Ponds[a]

Sample Location[b]	Depth	PCB Concentration[a]
Surface soil		
STP-3-SB		0.0576
STP-4-SB		1.4
STP-5-SB		0.248
STP-7-SS		0.0585
Subsurface soil		
STP-4-SB	9.0 feet	0.262

a. Values reported in milligrams per kilogram.
b. Refer to Figure 8.4.

Table 8.4: Summary of Analyte Concentrations in Groundwater - Large Sewage Treatment Ponds[a]

Sample Date	Maximum Facilitywide Background Concentration	Maximum Local Background Concentration[b]	Primary Maximum Contaminant Level		Stage 1			
			Federal	State	STP-2-MW 09/16/92	STP-2-MW-D 09/16/92	STP-2-MW 12/08/92	STP-2-MW-D 12/08/92
Inorganic Analytes								
Aluminum	141	NA	50-200[c]	1,000	186	159	--	--
Barium	74.1	24.8	2,000	1,000	68.5	72.2	92.8	97.2
Chloride	18,000,000	NA	250,000[c]	250,000[c]	180,000	180,000	341	334
Chromium (total)	9.62	6.02	100	50	22.4B	--	--	--
Copper	138	20.1	1,000[c]	1,000[c]	47.9B	40.7B	--	--
Iron	83.8	NA	300[c]	300[c]	118	231	--	--
Lead	6.3	1.84	15	50	--	--	--	--
Magnesium	471,000	NA	NA	NA	32,300	32,600	40,700	42,600
Manganese	66.5	NA	50[c]	50[c]	**90.7**	**91.3**	**64.7**	**66.2**
Nitrite, nitrate	NA	NA	10,000	45,000	2,900	2,900	2,000	2,000
Potassium	353,000	NA	NA	NA	20,600	20,500	24,700	26,000
Sulfate	14,000,000	NA	250,000[c]	250,000[c]	**400,000**	**400,000**	790	790
Total dissolved solids	NA	NA	500,000[c]	500,000[c]	**1,200,000**	**1,200,000**	**1,400,000**	**1,300,000**
Vanadium	969	NA	NA	NA	--	--	--	--
Zinc	28.7	28.7	5,000[c]	5,000[c]	55.9B	80.8B	--	--
Organic Analytes								
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane (DDT)	NA	NA	NA	NA	--	0.00298	--	--
alpha-Benzenehexachloride (alpha-BHC)	NA	NA	NA	NA	--	--	0.00442 C	--
alpha-Endosulfan	NA	NA	NA	NA	--	--	--	0.015
Caprolactum	NA	NA	NA	NA	--	--	--	--
Chloroform	NA	NA	100	100	--	--	--	--
delta-Benzenehexachloride (delta-BHC)	NA	NA	NA	NA	--	--	0.0492 U	0.0155
Dieldrin	NA	NA	NA	NA	0.0135	0.01	--	--
Heptachlor epoxide	NA	NA	0.2	0.01	**0.019**[d]	--	--	--
Hexadecanoic acid	NA	NA	NA	NA	--	--	--	--
Isodrin	NA	NA	NA	NA	0.00852	0.0116	--	0.0126
Trichloroethylene	NA	NA	5.0	5.0	---	---	---	---

Table 8.4: Summary of Analyte Concentrations in Groundwater - Large Sewage Treatment Ponds[a] (continued)

	Stage 3						
Sample Date	STP-2-MW 11/06/94	STP-2-MW-D 11/06/94	STP-2-MW 02/08/95	STP-3-PZ 11/04/94	STP-3-PZ 02/02/95	STP-4-PZ 11/03/94	STP-4-PZ 02/03/95
Inorganic Analytes							
Aluminum	--	--	--	--	--	--	**619**
Barium	46.5	47.2	53.1	65.9	99.8	53.1	59.1
Chloride	140,000	140,000	130,000	160,000	160,000	150,000	150,000
Chromium (total)	--	--	--	--	--	--	--
Copper	--	--	--	23.4	--	--	--
Iron	--	--	--	--	--	--	559
Lead	2.39	--	--	--	--	--	--
Magnesium	21,400	21,600	25,700	34,400	50,600	32,200	32,600
Manganese	13.8	13.8	**51.2**	**483**	**487**	**1,890**	**1,430**
Nitrite, nitrate	8,200	8,200	**21,000**	**57,000**	**36,000**	**23,000**	**34,000**
Potassium	18,600	19,000	18,500	17,900	19,900	22,400	--
Sulfate	240,000	240,000	**350,000**	**380,000**	**510,000**	**420,000**	**430,000**
Total dissolved solids	**1,000,000**	**1,020,000**	**1,200,000**	**14,500,000[b]**	--	--	--
Vanadium	30.3	32.4	29.7	19.4	**1,720,000**	**1,320,000**	**1,350,000**
Zinc	--	--	--	--	18.1	21.1	15.6
					--	--	--
Organic Analytes							
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane (DDT)	--	--	--	--			
Acetone	--	--	17.0	--	--	--	--
alpha-Benzenehexachloride (alpha-BHC)	--	--	--	--	--	--	--
alpha-Endosulfan	--	--	--	--	--	--	--
Caprolactum	90S	500S	--	--	5.00 S	--	10.0 S
Chloroform	--	--	--	--	--	--	--
delta-Benzenehexachloride (delta-BHC)	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--	--
Heptachlor epoxide	--	--	--	--	--	--	--
Hexadecanoic acid	2.0S	--	--	--	--	--	--
Isodrin	--	--	--	--	--	--	--
Trichloroethylene	--	--	--	--	--	--	--

Table 8.4: Summary of Analyte Concentrations In Groundwater - Large Sewage Treatment Ponds[a] (continued)

	Stage 3								
Sample Date	STP-5-PZ 11/03/94	STP-5-PZ 02/02/95	STP-5-PZD 02/02/95	STP-6-PZ 11/02/94	STP-6-PZ 02/01/95	STP-7-PZ 11/02/94	STP-7-PZ 02/02/95	STP-8-PZ 11/04/94	STP-8-PZ 02/03/95
Inorganic Analytes									
Aluminum	--	--	--	--	--	--	--	--	--
Barium	37.5	38.2	36.5	28.3	32	29.4	32.7	--	41.6
Chloride	99,000	100,000	100,000	120,000	110,000	**880,000**	81,000	130,000	150,000
Chromium (total)	--	--	--	--	--	--	--	--	--
Copper	--	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--	51.3
Lead	--	--	--	--	--	--	--	--	--
Magnesium	23,400	25,900	25,300	29,000	28,600	46,200	45,600	31,300	35,000
Manganese	4.95	--	--	18.6	8.63	21.6	5.21	**406**	**407**
Nitrite, nitrate	8,100	8,400	8,400	**11,000**	**12,000**	5,300	6,000	7,900	**16,000**
Potassium	25,200	22,900	24,000	17,400	15,600	26,200	23,000	19,100	19,000
Sulfate	220,000	220,000	220,000	**260,000**	**260,000**	**380,000**	**340,000**	**280,000**	**310,000**
Total dissolved solids	**894,000**	**946,000**	**943,000**	**1,100,000**	**1,100,000**	**10,070,000**	**1,100,000**	**1,130,000**	**1,300,000**
Vanadium	20.5	16.0	16.1	--	--	--	--	20.5	--
Zinc	--	--	--	--	--	--	--	--	19.3
		--	--						
Organic Analytes									
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane (DDT)	--	--	--	--	--	--	--	--	--
alpha-Benzenehexachloride (alpha-BHC)	--	--	--	--	--	--	--	--	--
alpha-Endosulfan	--	--	--	--	--	--	--	--	--
Caprolactum	--	--	40 S	--	--	--	**4.8**	--	**5.2**
Chloroform	--	--	--	--	30.0 S	--	20.0 S	--	300 S
delta-Benzenehexachloride (delta-BHC)	--	--	--	--	--	1.0	0.75	--	--
Dieldrin	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	--	--	--	--	--	--	--	--	--
Hexadecanoic acid	--	--	--	--	--	--	--	--	--
Isodrin	--	--	--	--	--	--	--	--	--
Trichloroethylene	--	1.20[d]	1.30[d]	--	--	--	--	--	--

Table 8.4: Summary of Analyte Concentrations in Groundwater - Large Sewage Treatment Ponds[a] (continued)

Analyte concentrations are micrograms per liter ($\mu g/l$).

Bold values exceed respective federal or state maximum contaminant level.

B Analyte found in the method blank or quality control blank as well as the samples.
C Analysis was confirmed.
D Duplicate sample
NA Not available
S Non-target analyte analyzed for and detected
-- Analyte not detected, or concentration is less than the respective maximum local (STP) background concentration.
STP Sewage treatment ponds
U Analysis unconfirmed

a. Large sewage treatment ponds groundwater analyte concentrations that exceed the respective maximum local background concentration.
b. Taken from HLA, 1994.
c. Secondary maximum contaminant level
d. Confirmation of reported detection subject to additional sampling of wells conducted in April 1995. Trichloroethylene was not detected in groundwater samples collected in April 1995 from this piezometer.
e. Data processing error at laboratory identified during data package review; reported concentration should be reduced by an order of magnitude.

Table 8.5: Summary of Multipathway Exposures at the Large Sewage Treatment Ponds

Receptor Populations Exposure Pathways	Hazard Index		Potential Upperbound Excess Cancer Risk	
	Average	RME	Average	RME
Current Scenario				
Adult Workers (Onsite)				
Dermal Contact with Soil	9.77E-02	7.54E-01	8.77E-06	1.51E-04
Inhalation of Dust from Outdoor Air	N/A	N/A	9.71E-06	5.23E-05
Ingestion of Soil	3.02E-01	8.24E-01	1.66E-06	1.11E-05
Multipathway Exposures	4E-01	2E+00	2E-05	2E-04
Future Scenario				
Construction Workers (Onsite)				
Ingestion of Soil	8.91E-02	2.34E-01	4.55E-07	1.08E-06
Dermal Contact with Soil	1.88E-02	1.24E-01	4.89E-07	3.03E-06
Inhalation of Dust from Outdoor Air	N/A	N/A	9.22E-07	1.78E-06
Multipathway Exposures	1E-01	4E-01	2E-06	6E-06
Child/Adult Residents (Onsite)				
Ingestion of Soil	4.16E+00	1.13E+01	1.84E-05	5.12E-05
Dermal Contact with Soil	5.31E-01	3.14E+00	4.04E-05	4.10E-04
Inhalation of Dust from Outdoor Air	N/A	N/A	1.03E-05	4.64E-05
Inhalation of Dust from Indoor Air	N/A	N/A	3.16E-05	1.17E-04
Multipathway Exposures	5E+00	1E+01	1E-04	6E-04
Adult Residents (Onsite)				
Ingestion of Soil	7.72E-01	1.05E+00	4.29E-06	1.70E-05
Dermal Contact with Soil	1.24E-01	7.74E-01	1.11E-05	1.86E-04
Inhalation of Dust from Outdoor Air	N/A	N/A	5.23E-07	5.81E-06
Inhalation of Dust from Indoor Air	N/A	N/A	6.58E-06	4.79E-05
Multipathway Exposures	9E-01	2E+00	2E-05	3E-04

N/A Not applicable
RME Reasonable maximum exposure

Table 8.6: Order of Magnitude Cost Estimate - Excavation and Offsite Disposal Large Sewage Treatment Ponds

Cost Item	Quantity Units	Unit Cost ($)	Preliminary Estimated Total Cost
Preconstruction Activities			
a. Mobilization	1 LS	3,000	$3,000
Subtotal - Preconstruction Activities			$3,000
Sitework			
a. Excavation and loading	3,400 CY	10	$34,000
Subtotal - Sitework			$34,000
Offsite Disposal			
a. Transportation	3,400 CY	25	$ 85,000
b. Disposal fees (including taxes)	3,400 CY	225	765,000
c. Waste characterization	1 LS	4,000	4,000
Subtotal - Offsite Disposal			$854,000
Other Direct Costs			
a. Engineering design	1 LS	4,500	$4,500
b. Engineering services during construction	1 LS	6,000	6,000
Subtotal - Other Direct Costs			$10,500
Subtotal Capital Costs			$901,500
Contingency (20 percent)			$180,300
Total Preliminary Capital Costs			$1,081,800

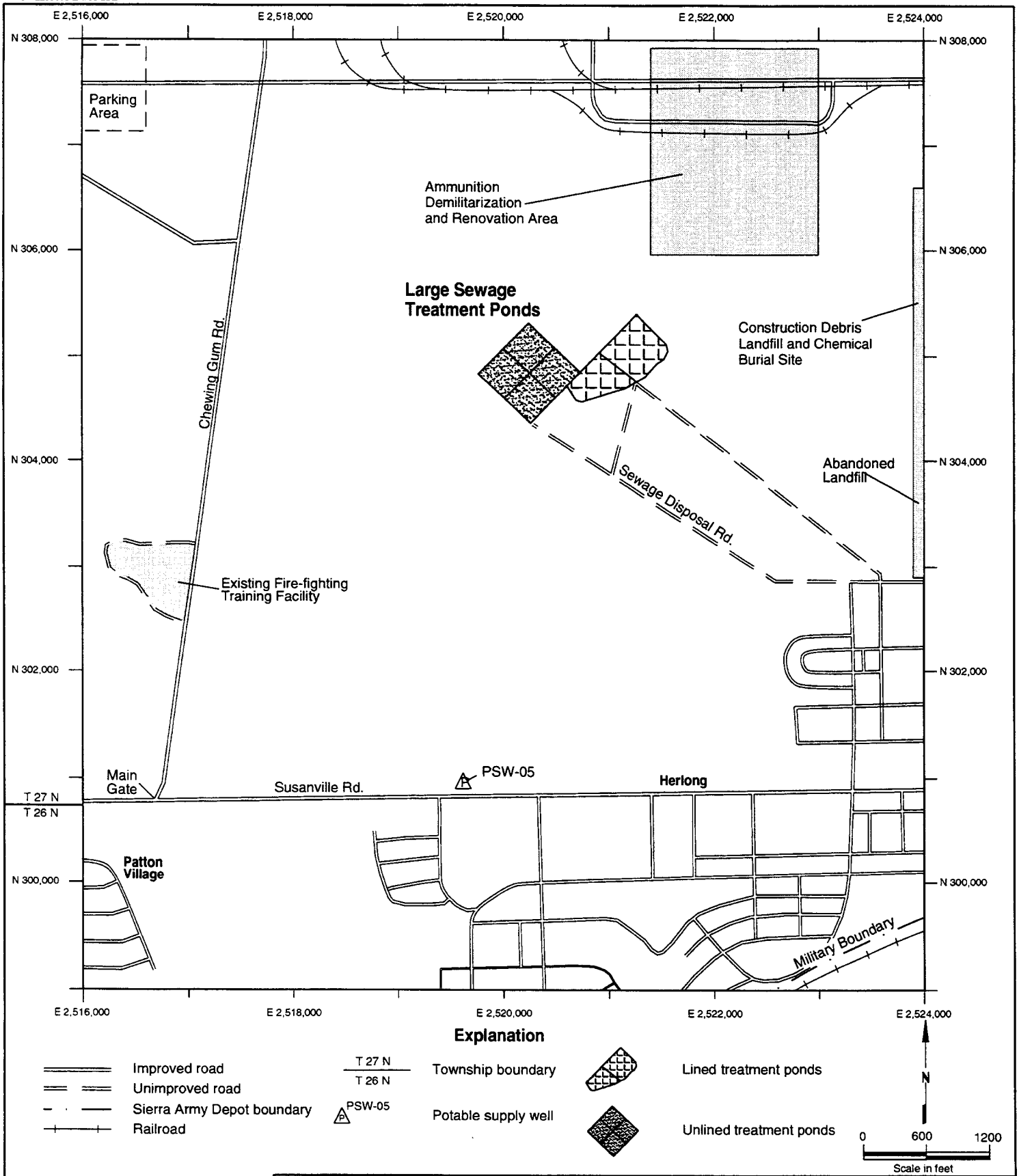
CY Cubic yards
LS Lump sum

Table 8.7: Applicable or Relevant and Appropriate Requirements for the Large Sewage Treatment Ponds

Standard, Requirement, Criterion, or Limitation	Citation	Description	Applicable or Relevant and Appropriate	Comment
Action-Specific				
Occupational Safety and Health Act	29 USC §§ 651-678	Regulates worker health and safety	Applicable	Under 40 CFR § 300.38, requirements of the Act apply to all response activities under the NCP.
Hazardous Waste Control Laws	H&S Code, Div. 2.0 Chapters 6.5 and 6.8 § 25100 et seq. CCR Title 22, Div. 4.5 Chapter 10, § 66001 et seq.	Regulations governing hazardous waste control; management and control of hazardous waste facilities; transportation; laboratories; classification of extremely hazardous, hazardous, and nonhazardous waste. Includes STLCs and TTLCs.	Applicable or relevant and appropriate	State hazardous waste control laws are considered applicable or relevant and appropriate operating standards for those alternatives involving treatment and disposal of hazardous waste.
Department of Transportation Material Shipment Regulations	49 CFR 100-180	Regulates the packaging, labeling, and shipping of hazardous materials	Applicable	Department of Transportation requirements apply to all shipments of hazardous materials.

CFR Code of Federal Regulations
NCP National Contingency Plan
STLC Soluble threshold limit concentration
TTLC Total threshold limit concentration
USC United States Code

SIAD/12299605 2/1/95 LDZ



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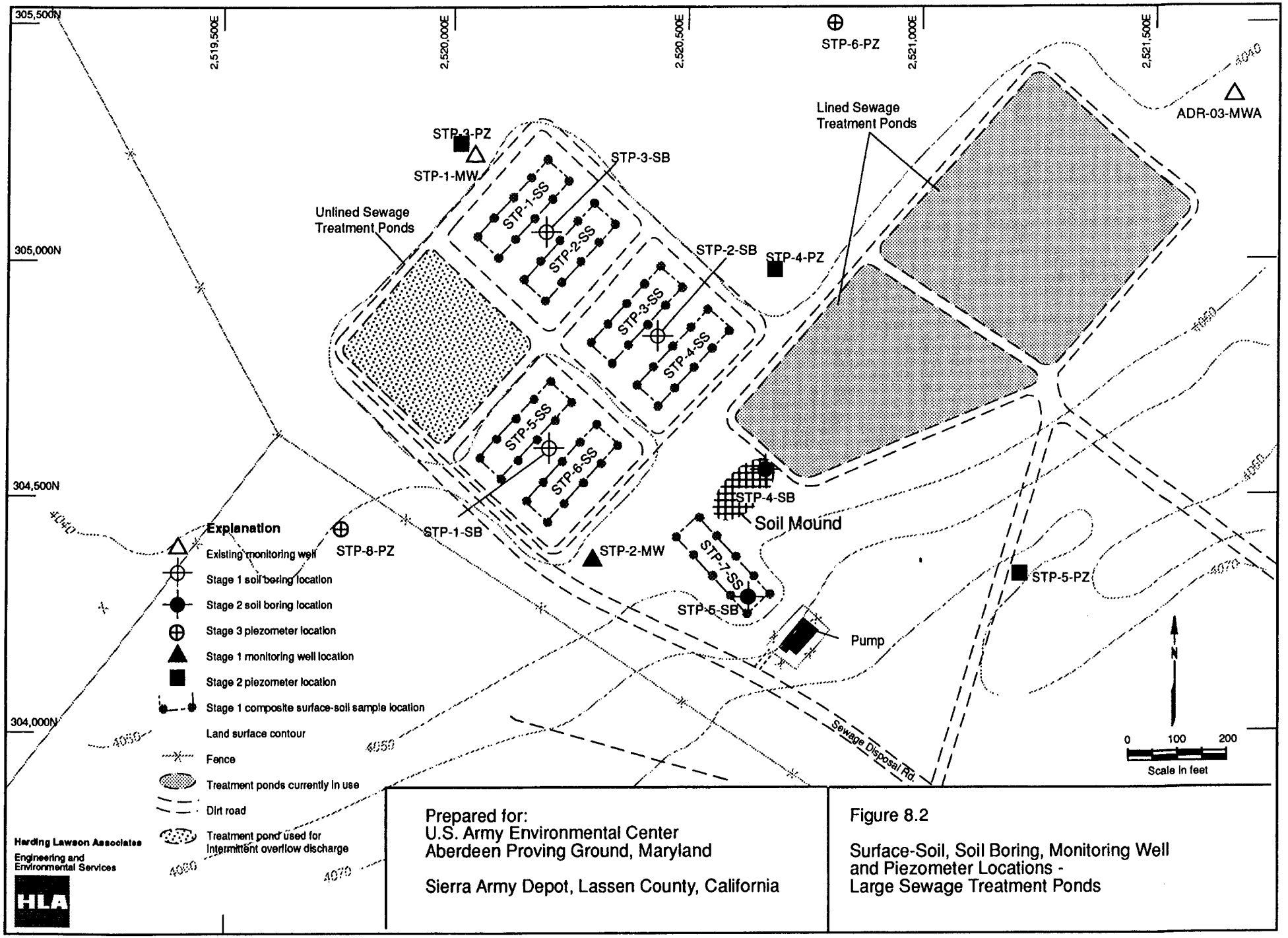
Aberdeen Proving Ground, Maryland

Sierra Army Depot, Lassen County, California

Figure 8.1

Location Map-
Large Sewage Treatment Ponds



SRA 1070.5a 02/01/96 ECS

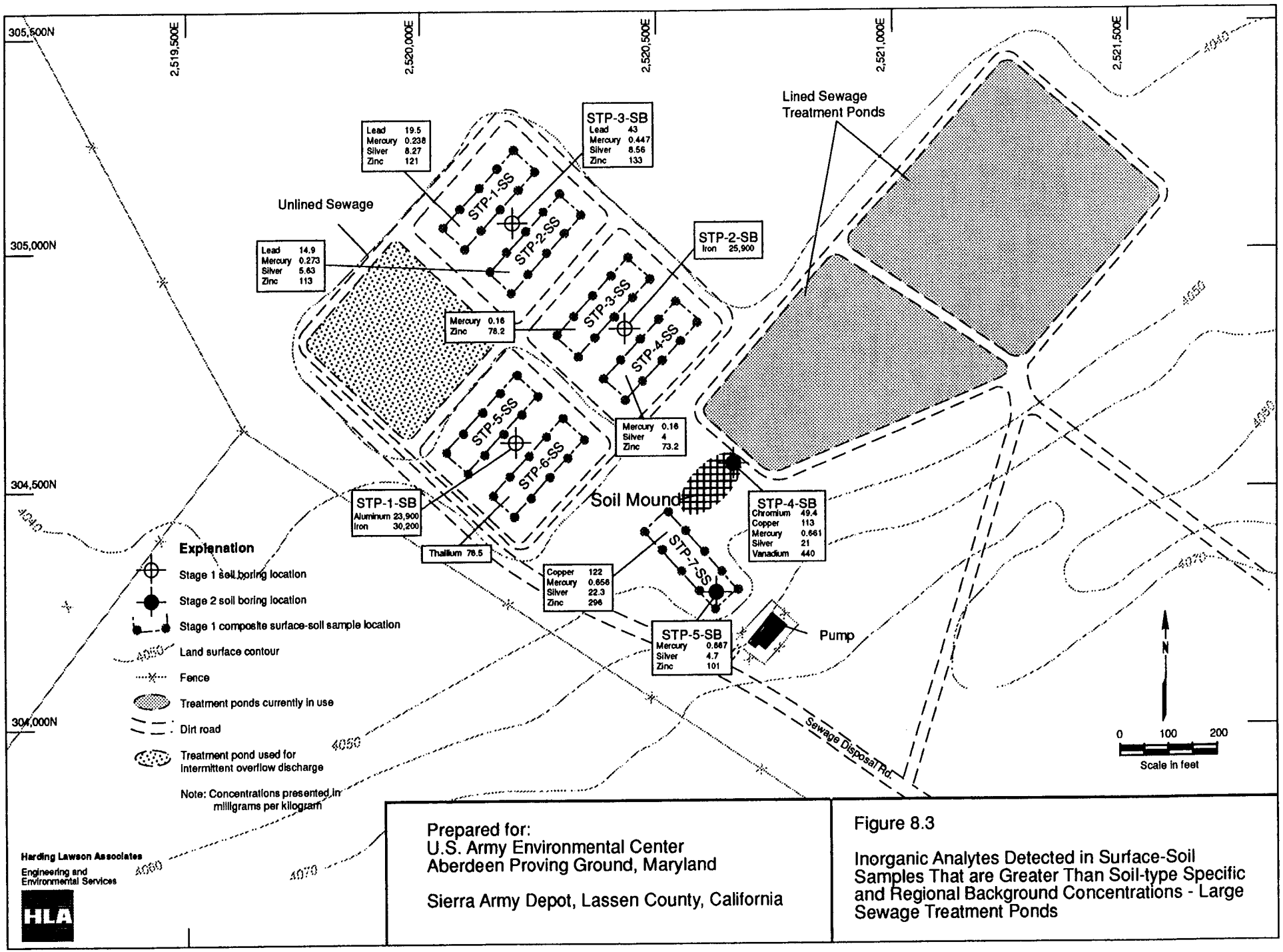


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Figure 8.3

Inorganic Analytes Detected in Surface-Soil Samples That are Greater Than Soil-type Specific and Regional Background Concentrations - Large Sewage Treatment Ponds

SRA 1070.6a 02/01/96 ECS

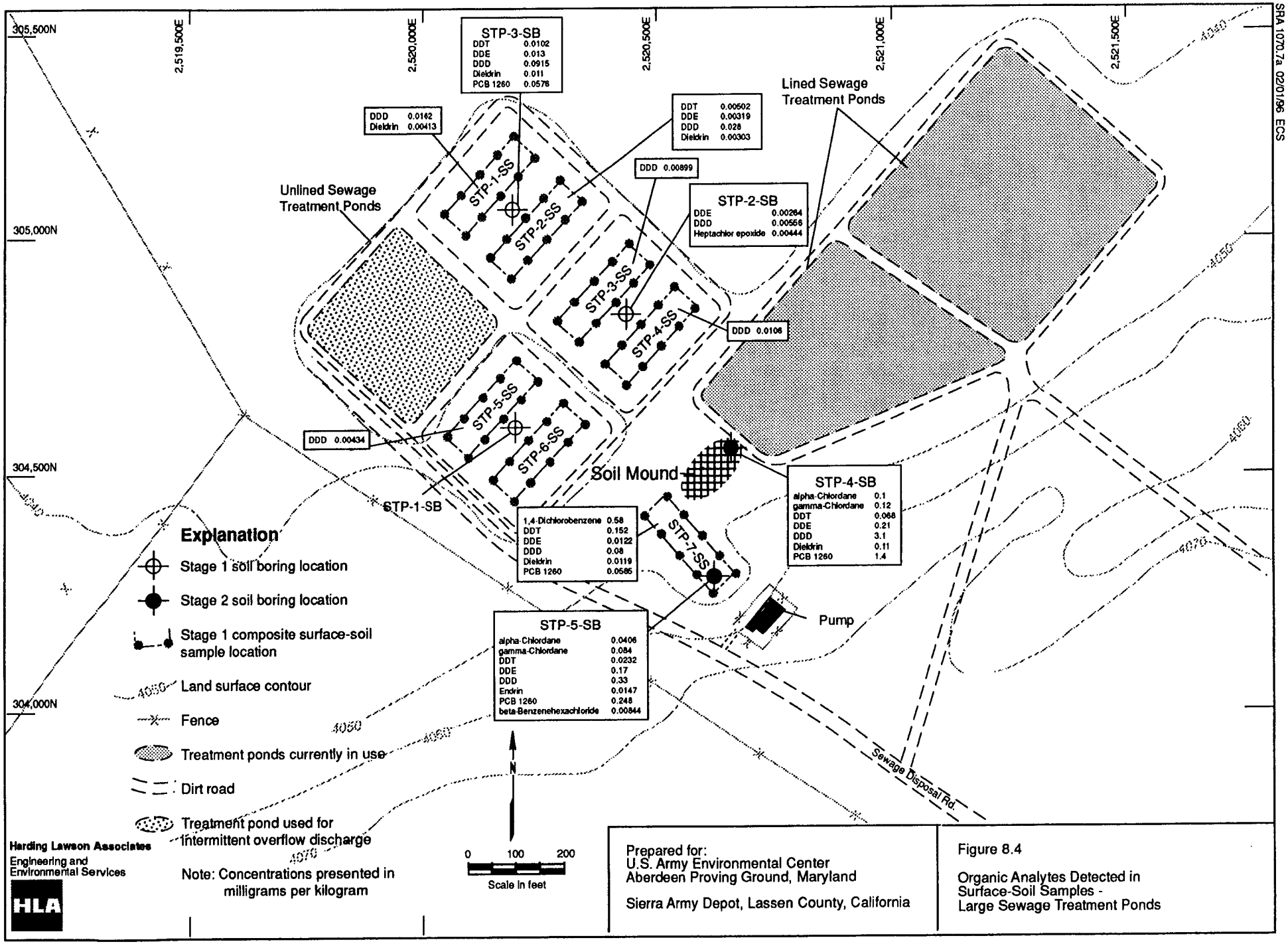
SRA 1070.7a 02/01/96 ECS
305,500N
305,000N
304,500N
304,000N
2,519,500E
2,520,000E
2,520,500E
2,521,000E
2,521,500E
STP-3-SB
DDT 0.0102
DDE 0.013
DDD 0.0915
Dieldrin 0.011
PCB 1260 0.0576
DDD 0.0162
Dieldrin 0.00413
DDT 0.00502
DDE 0.00319
DDD 0.028
Dieldrin 0.00303
DDD 0.00899
STP-2-SB
DDE 0.00264
DDD 0.00556
Heptachlor epoxide 0.00444
DDD 0.0106
DDD 0.00434
STP-1-SS
STP-2-SS
STP-3-SS
STP-4-SS
STP-5-SS
STP-6-SS
STP-7-SS
Unlined Sewage Treatment Ponds
Lined Sewage Treatment Ponds
Soil Mound
STP-1-SB
1,4-Dichlorobenzene 0.58
DDT 0.152
DDE 0.0122
DDD 0.08
Dieldrin 0.0119
PCB 1260 0.0585
STP-4-SB
alpha-Chlordane 0.1
gamma-Chlordane 0.12
DDT 0.068
DDE 0.21
DDD 3.1
Dieldrin 0.11
PCB 1260 1.4
STP-5-SB
alpha-Chlordane 0.0406
gamma-Chlordane 0.084
DDT 0.0232
DDE 0.17
DDD 0.33
Endrin 0.0147
PCB 1260 0.248
beta-Benzenehexachloride 0.00844
Pump
Sewage Disposal Rd.
4040
4050
4060
4070
Explanation
Stage 1 soil boring location
Stage 2 soil boring location
Stage 1 composite surface-soil sample location
Land surface contour
Fence
Treatment ponds currently in use
Dirt road
Treatment pond used for intermittent overflow discharge
Note: Concentrations presented in milligrams per kilogram
N
0 100 200
Scale in feet
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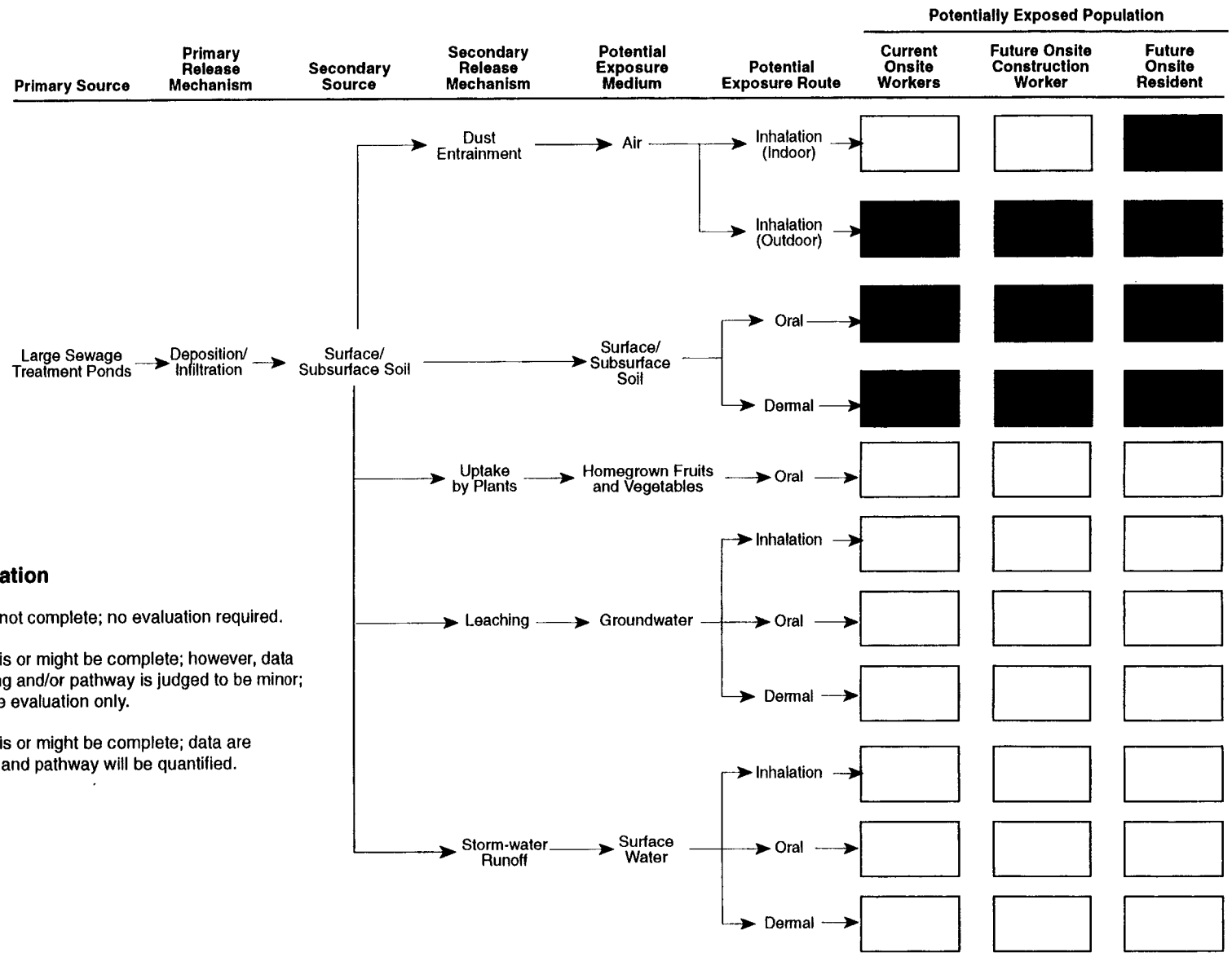
Figure 8.4
Organic Analytes Detected in Surface-Soil Samples - Large Sewage Treatment Ponds



Explanation

- Pathway not complete; no evaluation required.
- Pathway is or might be complete; however, data are lacking and/or pathway is judged to be minor; qualitative evaluation only.
- Pathway is or might be complete; data are available and pathway will be quantified.

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Figure 8.5

Conceptual Site Model -
Large Sewage Treatment Ponds

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